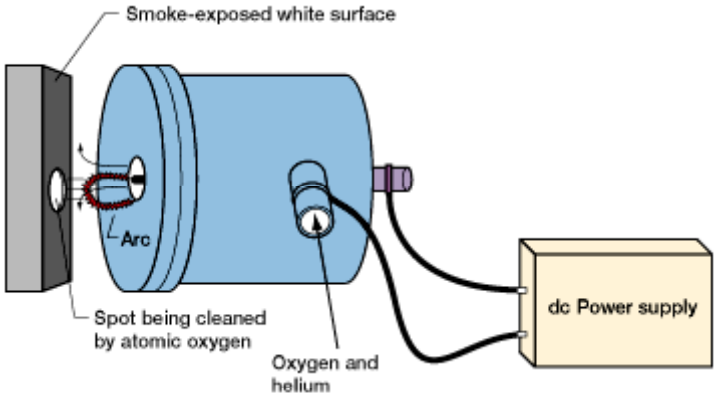
Atomic Oxygen Cleaning Shown to Remove Organic Contaminants at Atmospheric Pressure

Organic contaminants and coatings can be difficult to remove from delicate surfaces. Using harsh solvents or physical contact to clean such surfaces can result in damage. Testing the effects of the low-Earth-orbit environment on spacecraft surfaces has shown that the atomic oxygen present in space very readily reacts with most organic materials. The reaction converts the organic materials present on surfaces into gaseous components of mostly carbon monoxide, carbon dioxide, and water vapor. Because the reaction is limited to the surface, and there is no physical contact with the surface required other than a gentle flow of gas, atomic oxygen offers an attractive method to remove organic coatings and contaminants.

One of the drawbacks of using atomic oxygen is the rate at which it recombines to form molecular oxygen. This has required that any object to be cleaned be placed inside a vacuum chamber where the density of atomic oxygen can be kept low enough so that it reacts with the surface before recombining. Vacuum chambers, however, are not very portable and most are not large enough to accommodate many surfaces that need to be cleaned.



Atmospheric atomic oxygen cleaning system.

The NASA Lewis Research Center has developed and filed for a patent on a method to produce atomic oxygen at atmospheric pressure by using a direct current arc in a gas flow mixture of oxygen and helium. A prototype device has been tested for its ability to remove various soot residues from surfaces exposed to fire, and various varnishes such as acrylic and egg white. A typical soot deposit can be removed in an area about 0.5 cm in diameter in less than 2 minutes with optical restoration of the surface to very near its original condition. The device can be made into a hand-held unit that can be portable enough to use for cleaning sections of large objects in place. This process has many broad applications in both nonterrestrial and terrestrial areas. Some examples of these

applications are the removal of hydrocarbon contaminants from optical surfaces for spacecraft, decontamination of aircraft components, and removal of soot from artwork damaged during a fire.

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